

WHAT IS CLAIMED IS:

1. A method of removing photoresist and/or resist residue from a substrate, comprising the steps of:

5 (a) providing a substrate having photoresist material formed thereon;
(b) exposing the substrate to a co-solvent mixture comprising a carbonate, an oxidizer and an accelerator.

2. The method of claim 1, wherein the exposing step includes exposing the substrate
10 to a supercritical fluid in combination with the co-solvent mixture.

3. The method of claim 1 in which the carbonate is selected from the group consisting of 1,2-Butylene Carbonate, Ethylene Carbonate, Propylene Carbonate and mixtures thereof.

15 4. The method of claim 3, wherein the carbonate includes 1,2-Butylene Carbonate.

5. The method of claim 3, wherein the carbonate includes Propylene Carbonate.

20 6. The method of claim 3, wherein the carbonate includes Ethylene Carbonate.

7. The method of claim 1, wherein the co-solvent mixture includes Dimethyl Sulfoxide.

25 8. The method of claim 1, wherein the co-solvent mixture includes Benzyl Alcohol.

9. The method of claim 1, wherein the co-solvent mixture includes 1,2-Butylene Carbonate, and Dimethyl Sulfoxide.

10. The method of claim 1, wherein the co-solvent mixture includes 1,2-Butylene Carbonate and Benzyl Alcohol.

11. The method of claim 1, wherein the co-solvent mixture includes Propylene Carbonate and Benzyl Alcohol.

12. The method of claim 1, wherein the co-solvent mixture includes Ethylene Carbonate and Benzyl Alcohol.

13. The method of claim 1, wherein the co-solvent mixture includes an aqueous fluoride.

14. The method of claim 14, wherein the aqueous fluoride is selected from the group consisting of ammonium fluoride, ammonium bifluoride and hydrofluoric acid.

15. The method of claim 1, wherein the oxidizer is selected from the group consisting of hydrogen peroxide, benzoyl peroxide, urea peroxide and mixtures thereof.

16. The method of claim 15, wherein the oxidizer is 10-80% hydrogen peroxide.

17. The method of claim 1, wherein the accelerator is a C₁-C₂₂ carboxylic acid.

18. The method of claim 17, wherein the accelerator is selected from the group consisting of formic acid, acetic acid, oxalic acid, citric acid, maleic acid, malic acid, lactic acid, glycolic acid, and L-tartaric acid.

19. The method of claim 18, wherein the accelerator is formic acid.

20. The method of claim 1, wherein the accelerator is an organoamine.

21. The method of claim 20, wherein the accelerator is selected from the group consisting of diethanolamine, diglycolamine, ethylene diamine, isopropyl amine, monoethanol amine, morpholine, and triethanolamine.

5 22. The method of claim 1, wherein the accelerator is a salt.

23. The method of claim 22, wherein the accelerator is selected from the group consisting of ammonium carbamate, ammonium carbonate, ammonium formate, and hydroxy propyl carbamate.

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24. The method of claim 1, wherein the accelerator is a solvent.

25. The method of claim 24, wherein the solvent is an ether.

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26. The method of claim 25, wherein the ether is 1,3,5 Trioxane.

27. The method of claim 24, wherein the solvent is a glycol.

28. The method of claim 27, wherein the glycol is propylene glycol.

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29. The method of claim 24, wherein the solvent is a lower alkyl alcohol.

30. The method of claim 24, wherein the solvent is selected from the group consisting of methanol and ethanol and mixtures thereof.

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31. The method of claim 1, wherein the exposing step causes stripping of photoresist material from the substrate.

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32. The method of claim 1, wherein the exposing step cleans resist residue from the substrate.

33. The method of claim 31, wherein the co-solvent mixture is a first co-solvent mixture and wherein the method further includes the step of, after step (b), exposing the substrate to a second mixture comprising a supercritical fluid in combination with isopropyl alcohol.

34. The method of claim 33, wherein the second co-solvent mixture includes supercritical fluid in combination with isopropyl alcohol and water.

35. The method of claim 33, wherein the step of exposing the substrate to the second co-solvent mixture removes the first co-solvent mixture from the substrate and dries the substrate.

36. The method of claim 1, wherein the substrate includes I-line photoresist and wherein the method is for removing the I-line photoresist.

37. The method of claim 1, wherein the substrate is a substrate previously exposed to ion implantation.

38. The method of claim 1, wherein the substrate includes aluminum lines formed thereon.

39. The method of claim 1, wherein the substrate includes at least one integrated circuit device including low-dielectric constant materials.

40. The method of claim 1, wherein the substrate includes at least one integrated circuit device having high dielectric constant gate materials.

41. The method of claim 1, wherein the substrate includes back anti-reflective coating and wherein the method removes the back anti-reflective coating from the substrate.

42. The method of claim 1, wherein the substrate includes deep UV photoresist and wherein the method removes the DUV photoresist from the substrate.

43. The method of claim 1, wherein the substrate includes post-ash residues, and
5 wherein the method includes removing the post-ash residues from the substrate.

44. The method of claim 1, wherein the substrate includes photoresist and post-etch residues, and wherein exposure of the substrate to the co-solvent mixture removes both the photoresist and the post-etch residues from the substrate .

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45. The method of claim 1, wherein the supercritical fluid is supercritical carbon dioxide.

46. A composition for removing photoresist and/or resist residues from a substrate,
15 the composition comprising:
a co-solvent mixture comprising a carbonate, an oxidizer and an accelerator.

47. The composition of claim 46, further including a supercritical fluid in combination with the co-solvent mixture.

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48. The composition of claim 46 in which the carbonate is selected from the group consisting of 1,2-Butylene Carbonate, Ethylene Carbonate, Propylene Carbonate and mixtures thereof.

25 49. The composition of claim 48, wherein the carbonate includes 1,2-Butylene Carbonate.

50. The composition of claim 48, wherein the carbonate includes Propylene Carbonate.

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51. The composition of claim 48, wherein the carbonate includes Ethylene Carbonate.

52. The composition of claim 46, wherein the co-solvent mixture includes Dimethyl Sulfoxide.

53. The composition of claim 46, wherein the co-solvent mixture includes Benzyl Alcohol.

54. The composition of claim 46, wherein the co-solvent mixture includes 1,2-Butylene Carbonate, and Dimethyl Sulfoxide.

55. The composition of claim 46, wherein the co-solvent mixture includes 1,2-Butylene Carbonate and Benzyl Alcohol.

56. The composition of claim 46, wherein the co-solvent mixture includes Propylene Carbonate and Benzyl Alcohol.

57. The composition of claim 46, wherein the co-solvent mixture includes Ethylene Carbonate and Benzyl Alcohol.

58. The composition of claim 46, wherein the co-solvent mixture include an aqueous fluoride.

59. The composition of claim 58, wherein the aqueous fluoride is selected from the group consisting of ammonium fluoride, ammonium bifluoride and hydrofluoric acid.

60. The composition of claim 46, wherein the oxidizer is selected from the group consisting of hydrogen peroxide, benzoyl peroxide, urea peroxide and mixtures thereof.

61. The composition of claim 60, wherein the oxidizer is 10-80% hydrogen peroxide.

62. The composition of claim 46, wherein the accelerator is a C₁-C₂₂ carboxylic acid.

63. The composition of claim 46, wherein the accelerator is selected from the group
5 consisting of formic acid and acetic acid, oxalic acid, citric acid, maleic acid, malic acid, lactic acid, glycolic acid, and L-tartaric acid.

64. The composition of claim 63, wherein the accelerator is formic acid.

10 65. The composition of claim 46, wherein the accelerator is an organoamine.

66. The composition of claim 65, wherein the accelerator is selected from the group
consisting of diethanolamine, diglycolamine, ethylene diamine, isopropyl amine, monoethanol
amine, morpholine, and triethanolamine.

15 67. The composition of claim 46, wherein the accelerator is a salt.

68. The composition of claim 67, wherein the accelerator is selected from the group
consisting of ammonium carbamate, ammonium carbonate, ammonium formate, and hydroxy
20 propyl carbamate.

69. The composition of claim 30, wherein the supercritical fluid is supercritical
carbon dioxide.

25 70. A composition for removing photoresist and/or resist residue from a substrate, the
composition comprising including propylene carbonate, benzyl alcohol, hydrogen peroxide, and
formic acid.

71. The composition of claim 70, further including supercritical carbon dioxide.

72. A composition for removing photoresist and/or resist residual from a substrate, the composition comprising including propylene carbonate, benzyl alcohol and ethylene diamine.

73. The composition of claim 72, further including supercritical carbon dioxide.

5 74. A composition for removing photoresist and/or resist residual from a substrate, the composition comprising propylene carbonate, benzyl alcohol, formic acid, hydrogen peroxide, and an accelerator selected from the group consisting of hydroxyl propyl carbamate, propylene glycol and ammonium acetate in combination with deionized water.

10 75. A composition for removing photoresist and/or resist residue from a substrate, the composition comprising propylene carbonate, benzyl alcohol, hydroxyl propyl carbamate and hydrogen peroxide.

15 76. A composition for removing photoresist and/or resist residue from a substrate, the composition comprising propylene carbonate, benzyl alcohol, Trioxane and hydrogen peroxide.